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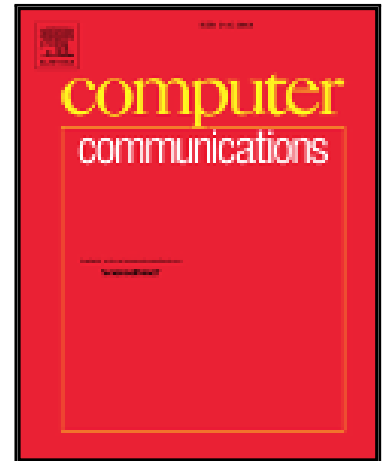
Reshaping the African Internet: From Scattered Islands to a
Connected Continent

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Reshaping the African Internet:
From Scattered Islands to a Connected Continent

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Abstract

There is an increasing awareness amongst developing regions on the importance of localizing Internet traffic in the quest for fast, affordable, and available Internet access. In this paper, we focus on Africa, where 37 IXPs are currently interconnecting local ISPs, but mostly at the country level. An option to enrich connectivity on the continent and incentivize content providers to establish presence in the region is to interconnect ISPs present at isolated IXPs by creating a distributed IXP layout spanning the continent. The goal of this paper is to investigate whether such IXP interconnection would be possible, and if successful, to estimate the best-case benefits that could be realized in terms of traffic localization and performance. Our hope is that quantitatively demonstrating the benefits will provide incentives for ISPs to intensify their peering relationships in the region. However, it is challenging to estimate this best-case scenario, due to numerous economic, political, and geographical factors influencing the region. Towards this end, we begin with a thorough analysis of the environment in Africa. We then investigate a naive approach to IXP interconnection, which shows that a theoretically optimal solution would be infeasible in practice due to the prevailing socio-economic conditions in the region. We therefore provide an innovative, realistic four-step interconnection scheme to achieve the distributed IXP layout that considers and parameterizes external socio-economic factors using publicly available datasets. We demonstrate that our constrained solution doubles the percentage of continental intra-African paths, reduces their lengths, and drastically decreases the median of their RTTs as well as RTTs to ASes hosting the top 10 global and top 10 regional Alexa websites. Our approach highlights how, given real-world constraints, a solution requires careful considerations in order to be practically realizable.

Keywords: African internet; Distributed IXP infrastructure; Interconnection scheme; Peering; Content providers

1. Introduction

The African continent, with a total of 1.2 billion inhabitants in its 54 countries, represents the next frontier in terms of end-users that are not connected to the Internet [42, 50, 62] — per ITU stats, only 23% of its population has access to the Internet as of June 2016 [48, 49]. The African Internet ecosystem is experiencing classic "growing pains": A few Internet Service Providers (ISPs) currently operate in each country, and in many countries the ISP market is dominated by one or two large players. There are 37 local Internet eXchange Points (IXPs) as of March 2016 [32, 97]. However, only 29 of the 58 countries in the region (including nearby islands such as Sao Tome Principe, Mayotte, etc.) have at least one IXP, and the average number of IXP members is 16. While

local IXPs are being set up at a fast rate [1] and prior studies have demonstrated the benefits that new IXPs can bring [29, 30], some local ISPs are hesitant to peer at those IXPs [43]. Adding to the difficulties, terrestrial fiber deployment remains fragmented [66, 91], since fewer technical and political hurdles make submarine fiber cheaper to build than inland fiber [12, 95].

A major reason behind the stunted growth of the African Internet ecosystem is that the region suffers from a lack of local content [31, 52, 63]. Content is mostly served from the United States (US) and Europe (EU), and even the most popular regional websites are hosted abroad, as investigated in [31]. Consequently, most local ISPs still doubt the value of peering at local IXPs. Those that peer locally are interconnected, but mostly at the country level. In developing regions, it is essential to not only localize traffic but also analyze existing infrastructures for opportunities to improve Internet services at an affordable cost

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[1]18 new IXPs were established in Africa from July 2014 to July 2015 [2, 72]